

CLAIMS

1. Process for the preparation of a polymer or copolymer comprising a step of polymerization or copolymerization of at least one monomer ~~which can be~~ ~~polymerized~~ via a radical route, in the presence of a polymerization or copolymerization initiator and of a stable free radical, the ~~said~~ step being such that, per 100 mol of monomer, the following relationships are confirmed:

$$\frac{F_{SFR} \times (SFR)}{F_{INIT} \times (INIT)} < 0.15$$

and

$$F_{SFR} \times (SFR) < 0.2 \text{ mol,}$$

15 in which

(SFR) represents the number of moles of stable free radical in the polymerization or copolymerization medium,

20  $F_{SFR}$  represents the functionality of the stable free radical, i.e. the number of sites on the same stable free radical molecule in stable free radical form,

25 (INIT) represents the number of moles of polymerization or copolymerization initiator in the polymerization or copolymerization medium,

$F_{INIT}$  represents the functionality of the initiator, i.e. the number of sites in free

5 Sub 101  
radical form which each initiator molecule is capable of generating.

2. Process according to Claim 1, characterized in that the step is such that the following relationship is confirmed:

$$0.0005 < \frac{F_{SFR} \times (SFR)}{F_{INIT} \times (INIT)} < 0.15$$

3. Process according to Claim 2, characterized in that the step is such that the following relationship is confirmed:

$$0.005 < \frac{F_{SFR} \times (SFR)}{F_{INIT} \times (INIT)} < 0.1$$

4. Process according to Claim 3, characterized in that the step is such that the following relationship is confirmed:

$$0.005 < \frac{F_{SFR} \times (SFR)}{F_{INIT} \times (INIT)} < 0.05$$

5 Process according to <sup>claim 1</sup> one of claims 1 to 4, characterized in that the step is such that, per 100 mol of monomer,  $F_{INIT} \times (INIT)$  ranges from 0.01 to 20 mol.

6. Process according to Claim 5, characterized in that the step is such that, per 100 mol of monomer,  $F_{INIT} \times (INIT)$  ranges from 0.1 to 2 mol.

7. Process according to <sup>claim 1</sup> ~~one of the~~ preceding claims, characterized in that the step is such that, per 100 mol of monomer,  $F_{SFR} \times (SFR)$  ranges from 0.0001 to 0.2.

5 8. Process according to Claim 7, characterized in that the step is such that, per 100 mol of monomer,  $F_{SFR} \times (SFR)$  ranges from 0.0005 to 0.1.

9. Process according to <sup>claim 1</sup> ~~one of the~~ preceding claims, characterized in that the step of the  
10 process according to the invention is carried out in the presence of a solvent in a proportion of from 0 to 20% by weight of the sum of the mass of monomer and solvent.

10. Process according to Claim 9,  
15 characterized in that the step of the process according to the invention is carried out in the presence of a solvent in a proportion of from 0 to 10% by weight of the sum of the mass of monomer and solvent.

11. Process according to Claim 10,  
20 characterized in that the step of the process according to the invention is carried out in the absence of solvent.

12. Process according to <sup>claim 1</sup> ~~one of the~~ preceding claims, characterized in that the step is  
25 carried out at from 100 to 250°C.

13. Process according to Claim 12, characterized in that the step is carried out at from 130 to 200°C.

14. Process according to <sup>claim 1</sup> ~~one of the~~  
~~preceding claims~~, characterized in that the step is  
carried out with a degree of conversion of monomer of  
greater than 50%.

5 15. Process according to Claim 14,  
characterized in that the step is carried out with a  
degree of conversion of monomer of greater than 90%.

16. Process according to <sup>claim 1</sup> ~~one of the~~  
~~preceding claims~~, characterized in that the temperature  
10 during the step and in that the initiator are chosen  
such that the half-life of the initiator at the said  
temperature ranges from 30 seconds to 1 hour.

17. Process according to Claim 16,  
characterized in that the half-life of the initiator at  
15 the chosen temperature ranges from 5 minutes to 30  
minutes.

18. Process according to <sup>claim 1</sup> ~~one of the~~  
~~preceding claims~~, characterized in that the initiator  
is chosen from diacyl peroxides, dialkyl peroxides and  
20 peroxyacetals.

19. Process according to <sup>claim 1</sup> ~~one of the~~  
~~preceding claims~~, characterized in that at least one  
monomer is from the methacrylate family.

20. Process according to <sup>claim 1</sup> ~~one of the~~  
~~preceding claims~~, characterized in that at least one  
25 monomer is a butyl methacrylate.

21. Process for the preparation of a block  
polymer comprising a step according to <sup>claim 1</sup> ~~one of claims 1~~

~~to 20~~, leading to the formation of a first living block, followed by the formation of at least one block of a monomer which is different from the one used for the said step.

5                    22. Process for the preparation of a diblock polymer, comprising a step according to <sup>claim 1</sup> ~~one of claims 1 to 20~~, leading to a first living block of a first monomer, followed by a step during which the first living block is placed in the presence of a second  
10 monomer which is polymerized, so as to form a second block attached to the first block.

                    23. Process for the preparation of a triblock polymer comprising a step of polymerization of a third monomer in the presence of the diblock polymer  
15 prepared by the process of Claim 22, so as to form a third block attached to the diblock polymer.

                    24. Process according to <sup>claim 21</sup> ~~one of claims 21 to 23~~, characterized in that, between the formation of two blocks, the temperature is at least equal to the lower  
20 temperature used to produce one of the two blocks.

                    25. Process according to <sup>claim 21</sup> ~~one of claims 21 to 23~~, characterized in that, between the formation of two blocks, the temperature remains at least equal to 100°C.

25                    26. Process for the preparation of a grafted polymer comprising a step according to <sup>claim 1</sup> ~~one of claims 1 to 20~~, in which step the initiator is a macroinitiator comprising a polymer in which at least one atom is

capable of taking a radical form capable of initiating the polymerization of a first monomer in order to form a first living block grafted to the polymer.

27. Process for the preparation of a polymer  
5 grafted with a diblock copolymer, comprising a step of polymerization of a second monomer in the presence of the polymer grafted by the process of Claim 26.

28. Process according to <sup>claim</sup>~~one of the~~  
~~preceding claims~~, characterized in that it is carried  
10 out at least partially in an extruder.

29. Process according to Claim 28,  
characterized in that all of the polymerization steps are carried out in an extruder.

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